OPERATOR MANUAL

Castle®
2410MB
Surgical Field Light

GETINGE Castle

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2410MB
Surgical Field Light

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GETINGE Castle

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DESCRIPTION OF SYMBOLS & NOTES IN MANUAL

The following symbols with related notes appear In this manual.

"Warning" notes alert the user to the possibility of personal injury.

"Caution" notes alert the user to the possibility of damage to the equipment.

"Notes" alert the user to pertinent facts and conditions.

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IMPORTANT

SPECIAL SAFETY INSTRUCTIONS THAT FOLLOW APPEAR WITHIN THE MANUAL. READ THEM CAREFULLY BEFORE OPERATING THE UNIT AND FOLLOW INSTRUCTIONS.

"Warning" notes alert the user to a possibility of personal injury.

SAFETY PRECAUTIONS (p. 3-1)

These steps should be observed for the safety of the patient and operating personnel when using the light. Failure to follow these safety steps could result in injury to the patient and user.

MOVING THE LIGHT (p. 3-1)

To avoid injury, hold on to the support arm when moving the light.

LIGHT OPERATION (p. 3-2)

The Castle 2410MB Surgical Light is not designed to be used in areas where flammable anesthetics may be present.

As in all high intensity lighting systems, a portion of the systems radiant output can cause a temperature increase and subsequent drying. Even though the effect is minimal, the light should be turned off or directed onto another area when not required, especially during lengthy procedures.

CLEANING EXTERIOR SURFACES (p. 5-1)

To avoid electrical shock, disconnect or turn off the power source to the light before performing any maintenance or cleaning procedures. Allow the lighthead to cool before touching any internal parts.

CLEANING OPTICAL SURFACES (p. 5-1)

The blue-green heat filter and lens must be in place to prevent ultraviolet and infrared rays from reaching the patient operator.

REPLACING BULB (p. 5-2)

Disconnect or turn off the power source to the light before performing any maintenance. Allow the lighthead to cool before touching any internal parts.

The blue-green heat filter and lens must be in place to prevent ultraviolet and infrared rays from reaching the patient or operator.

REPLACING HEAT FILTER (p. 5-3)

Turn OFF the light before performing any maintenance. Allow a 15 minute cool-off period to avoid touching hot lighthead parts.

The blue-green heat filter and the lens must be in place to prevent unfiltered rays from reaching the operator or patient.

POWER SUPPLY CALIBRATION (p. 5-6)

To avoid electrical shock, use caution when making power supply adjustments. Disconnect line cord before connecting test equipment. Use an insulated adjustment tool to avoid contact with power supply components.

TROUBLE ANALYSIS GUIDE (p. 6-1)

Several of these checks are made with the power ON Only trained service personnel should make these tests.

REPLACING LAMP CONTACT (p. 7-2)

To avoid electrical shock, disconnect or turn off power to the light before performaning any maintenance or repair procedures.

REPLACING REFLECTOR (p. 7-3)

Disconnect or turn off power source to the light before any maintenance to avoid hazardous electrical contact. Allow a 15 minute cool-off period to avoid touching hot lighthead parts.

REPLACING GAS SPRING (p. 7-4)

To avoid electrical shock, disconnect or turn off power to the light before performing any maintenance or repair procedures.

REMOVING LIGHTHEAD/ YOKE ASSEMBLY (p. 7-5)

The support arm will spring upward when the lighthead is removed. Secure arm to prevent pivot movement.

STEPS FOR SAFETY

These steps should be observed for the safety of the patient and operating personnel when using the light. Failure to follow these safety steps could result in injury to the patient and user.

a. Although great emphasis, research, and consideration have gone into the design for safety of this product, abuse and misuse could cause potentially unsafe conditions.

b. The doctor or other personnel must move the light out of the way before a patient gets up from the table.

c. Do not let a patient use the light as a handle to get up from the table.

d. Do not use the light with the lens removed or hanging by the retaining strap.

e. Do not lean on light.

f. Do not move this equipment in a violent fashion.

GENERAL SAFETY PRECAUTIONS

a. Read all instructions.

b. Do not touch hot surfaces. Use handles.

c. Use close supervision when equipment is used on or near children.

d. Do not operate if light malfunctions or has been damaged.

e. Use this light only for its intended use, as a surgical light, as described in this manual.

f. Turn off light when not in use.

9. Do not use light when damaged or broken electrical parts or connections.

h. The use of any accessory attachments not sold or recommended by the Company may cause hazards.

i. Do not expose electrical components to liquids.

j. Do not run variable height operating tables, track mounted scanning x-rays, or other equipment into the lighthead, arms or suspension system.

GENERAL INFORMATION

1-1 INTRODUCTION

The Castle 2410MB Surgical Field Light consists of a lighthead and counterbalance arm assembly, support posts, and base assembly. Arm pivots enable the lighthead to be positioned for surgical procedures. Lighthead pivots provide tilt and rotational adjustments.

The lighthead assembly contains the optical system of the light. The reflector directs a high intensity pattern onto the patient. A blue-green filter surrounding the light source color-corrects the light and filters heat. A frosted lens diffuses the light beam.

The lighthead and counterbalance arm assembly is mounted on a vertical post attached to the base. The base is equipped with wheels for portability.

The light can be operated from a 115V or 230V, 50 or 60 Hz power source, from the internal backup battery, or from an external 24V battery.

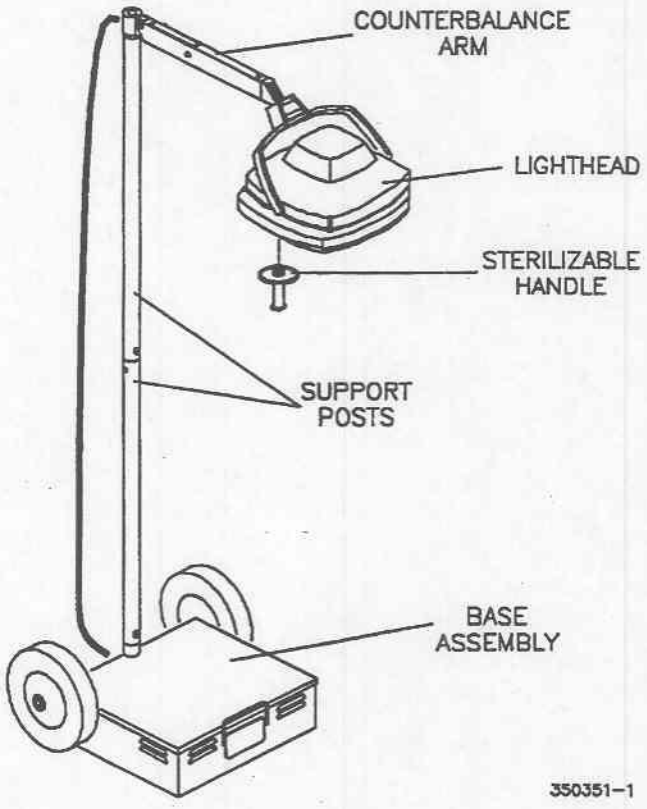


FIGURE 1-1. CASTLE 2410MB SURGICAL FIELD LIGHT

1-2 SALIENT CHARACTERISTICS

a. Shall be a portable, floor-standing (with casters), operating and examining light equipped for battery operation to provide continued light output in areas with intermittent input power.

b. Shall be suitable for use within hardwall shelters in military field medical facilities, as well as all fixed medical and dental facilities, M.U.S.T. units, and Forward Aid Stations.

c. Shall provide surgical quality light for use in applications where high intensities are needed, but field size requirements are less critical than major surgery.

d. Shall be designed to assemble and disassemble, in 5 minutes or less, for operation and storage within its own reusable shipping container.

e. The design shall permit the lighthead to be raised to 6'6" and lowered to 3'10" above the finished floor. The extension arm shall be 26" from the mounting post to the lighthead center. The extension arm shall pivot 90° around the mounting tube. The lamphead yoke shall rotate 180° around the extension arm. The lamphead shall rotate 180° within the yoke.

f. Shall weigh not more than 60 lbs. without batteries and 96 lbs. with batteries.

The base of the light shall contain the electronics and batteries. It shall be constructed of steel and have no openings on the bottom surface or sides for depth of 3". The light shall rest evenly on a flat surface without rocking. It shall not have any burrs, slivers, or sharp edges. The base shall be so configured, and sufficiently heavy, that the light shall not tip over throughout the full range of lighthead and extension arm movement. The base shall have as a minimum two casters, a minimum of 10" in diameter, to provide for easy portability and transport over uneven floor surfaces of field hospitals or aid stations.

The upright mounting tube shall be 1-1/2" diameter tubing with a wall thickness of 1/8". The tube shall be no more than 36" long. The tube shall be designed with a pinned, quick lock connector at the point of attachment to the base and on the tube interconnection point.

i. The extension arm shall be made of extruded 1" x 2" aluminum and shall be of conventional design. The arm shall be attached to the upper end of the upright mounting tube.

j. Shall operate within a range of 95 - 135 VAC, 2.5 AMP, and 190 - 270 VAC, 1.25 AMP, with not more than a 5% change in footcandle intensity, when plugged into a standard three-prong grounded receptacle. Input voltage range shall be determined and selected automatically by controls within the light fixture. The light shall be equipped with an automatic switching device for battery operation in the event of an interruption of input power. Shall operate on 50 or 60 Hz power systems.

k. For battery operation, two 12 VDC, deep cycle, sealed batteries are required to achieve a nominal 24 VDC lamp voltage. The cut-off voltage for testing shall be 87.5% of the nominal voltage or 21 VDC. The battery changer circuit shall be incorporated into the solid-state controls. (21 VDC to fully charge in 8 hours maximum)

l. Shall be supplied with a flexible, three-conductor, rubber-covered, No. 18 AWG or heavier, power cord, 11 feet in length, measured from plug to base. The three-prong hospital-grade plug shall be as specified in UL 498, which is compatible with the receptacle specified in ANSI C73.11. Suitable strain relief shall be provided in accordance with UL 544.

m. The lamphead shall be equipped with a 60 W, 24 V quartz halogen lamp having a rated average life of 500 hours. It shall be capable of providing approximately 3500 foot candles of illumination at the center of the spot 36" from the lower rim of the lamphead when lighthead is in horizontal position. Color correction shall be approximately 4000°K. The irradiance factor shall not exceed 5.0 $\mu W/cm^2$ per footcandle. The light shall have a universal focus design so the beam will be in proper focus through the normal range of use. The lighthead shall be 14" across and approximately square in shape. The lens area shall be approximately 103 in 2, circular in shape. The lamphead shall be 7" high and designed so that it is shatterproof to the point that no particles are emitted from the lamphead should a bulb self-destruct.

n. The lighthead shall be made of polycarbonate resins. The reflector shall be dichroic-coated polytherimide, 10.5" diameter, which transmits lamp heat upward and reflects cool visible light onto the surgical field. The lighthead shall have a closed-dome construction sufficiently vented to. limit the external temperature of surfaces not normally in human contact to 185°F.

o. Color correction shall be achieved by a cylindrical type uro H10 glass filter and the dichroic-coated reflector. Heat dissipation shall be achieved by absorption into the glass filter and heat transmitted through the dichroic coating on the reflector.

p. Shall be supplied with two handles: one permanently attached and a detachable sterilizable one.

q. Shall be supplied with an on/off switch and shall incorporate a "soft start" feature to eliminate initial filament "shock".

r. Shall be field repairable with common hand tools, with lamp replacement taking less than one minute and requiring no tools.

s. Shall be packed in Medical Instrument and Supply Set, Field No. 3 Chest (NSN: 6545-00-914-3480) modified in accordance with DPSC Drawing No. 25010. The chest shall be rainproof after modification and shall be olive drab in color.

t. Finish shall be highly fungus, mildew, corrosion, and salt-spray resistant. The unit shall have the manufacturer's highest quality commercially available, easily cleaned, washable finish.

   The following paint process and finish shall be minimum requirements for tripod, suspension tube, yoke assembly, and arms:

   (1) alkaline spray clean
   (2) rinse
   (3) zinc phosphate
   (4) rinse
   (5) non-chromic acid rinse
   (6) polyurethane color coat
   (7) air dry
   (8) polyurethane texture coat
   (9) bake

   The following process shall be minimum requirements for the lamphead:

   (1) polyurethane color coat
   (2) air dry
   (3) polyurethane texture coat
   (4) bake

u. Fixture shall meet the requirements of:
   (1) National Electric Code, as prescribed in National Fire Protection Association Pamphlet NFPA No. 56A
   (2) UL 544 — Medical and Dental Equipment
   (3) UL 153 — Portable Electric Lamps
   (4) UL 498 — Electrical Attachment Plugs and Receptacles.

v. Shall be equipped with a voltage sensor to prevent battery overcharge. The sensor will interrupt the battery charger when the battery voltage reaches 28 volts. The interrupt will be removed when the voltage reaches 24 volts.

w. Shall be equipped with a DC analog voltage meter to indicate the battery voltage level. The scale is green for voltages greater than or equal to 24 volts.

1-3 TECHNICAL DATA

1-3.1 Electrical Requirements

Input Voltage — 115 VAC, 50/60 Hz, 2.5 AMP; 230 VAC,1.25 AMP, 50/60 Hz; or external 24V battery.

1-3.2 Optical System

a. Lamp — 24V, 60W, Tungsten-Halogen, Bayonet Base
b. Heat Filter — Blue-Green, Color-Correcting
c. Reflector — Dichroic-Coated, Color-Correcting
d. Lens — Diffused Cover

1-3.3 Physical

a. Lighthead Vertical Travel — 6'6" maximum, 3'10" minimum above finished floor.
b. Weight — 60 lbs. maximum without batteries. 96 lbs. maximum with batteries.

1-4 LIST OF ITEMS FURNISHED

a. Counterbalance Arm and Lighthead Assembly
b. Upper Support Post
c. Lower Support Post
d. Base Assembly (includes wheels and pins)
e. Sterilizable Handles (2)
f. Instruction Manual
g. Medical Instrument and Supply Set, Field No. 3 Chest (NSN: 6545-00-914-3480), modified in accordance with DPSC Drawing No. 25010.

1-5 LIST OF ITEMS REQUIRED

Three-conductor Power Cable (for optional external 24V battery).

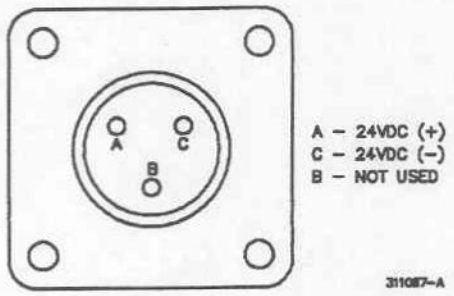


FIGURE 1-2 EXTERNAL BATTERY RECEPTACLE

1-6 STORAGE INSTRUCTIONS

a. Indoor Storage — In military box.
b. Outdoor Storage — In military box and sealed containers.

NOTE

If light is stored for an extended period of time, remove batteries or charge them every 2 months.

c. Height — Four (4) boxes high.
d. Humidity — No restriction.
e. Temperature — -20 to 110°F
f. Facility — No special facility.
9. Inspection — Periodically perform a visual inspection check — suggest once a year.

1-7 WARRANTY INFORMATION

Refer to the warranty registration card packed with the unit for terms and conditions.

INSTALLATION

2-1 UNPACKING

CAUTION

Be sure to remove shipping material from around blue-green heat filter before operating light.

a. Remove unit from container.

b. Check packing list to confirm receipt of all components.

2-2 TOOLS AND TEST EQUIPMENT

No special tools or test equipment are required to assemble the light.

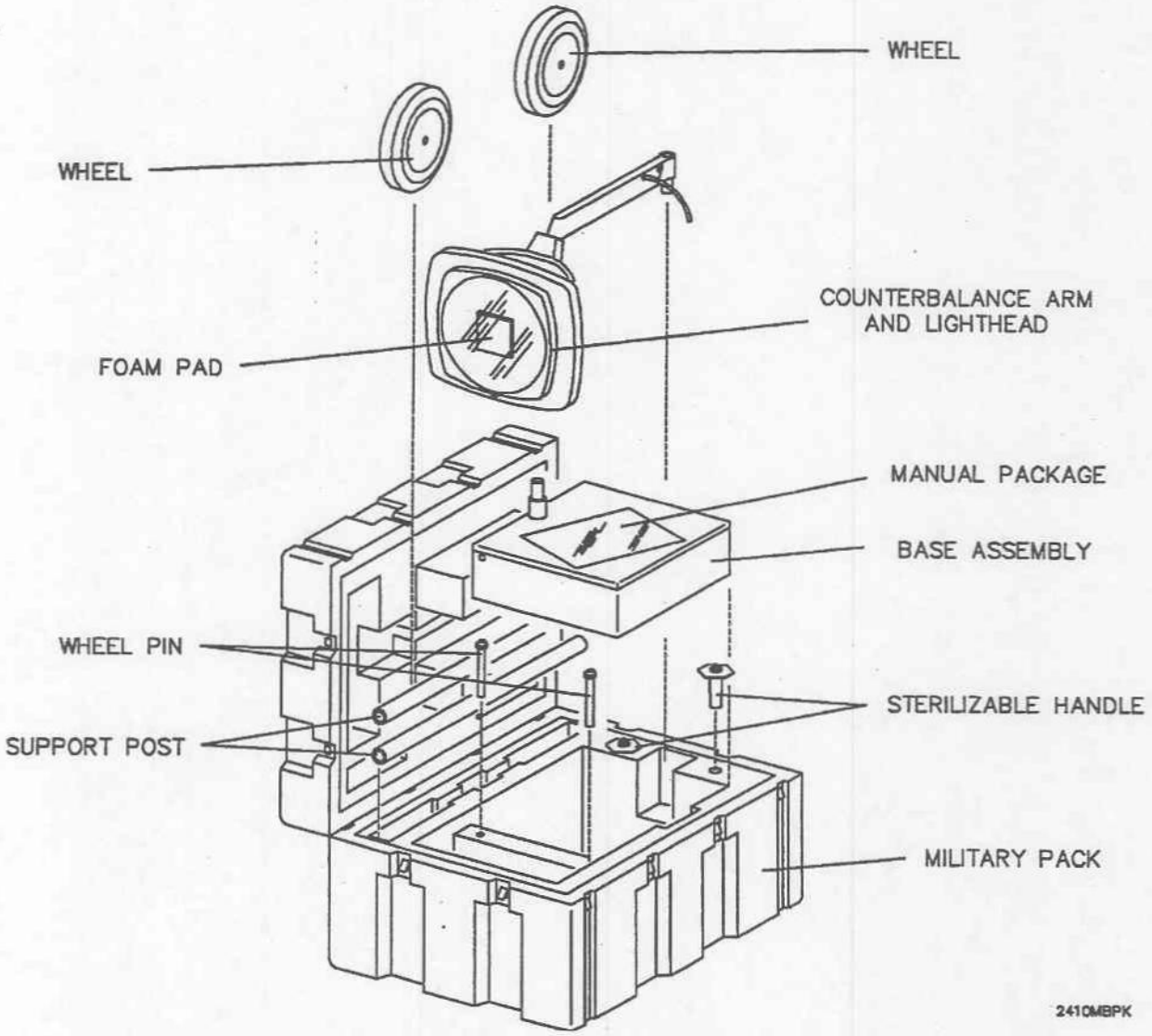


FIGURE 2-1. MILITARY PACK

2-3 FIELD INSTALLATION

a. Secure the wheels to the base assembly with pins.

b. Attach lower support post to base assembly. The lower support post has a quick-release button.

c. Attach upper support post to lower post.

d. Insert lighthead and counterbalance arm assembly into upper post. The upper post has a keyway that limits the rotation of the support arm.

e. Remove the foam pad from between the cylinder and the lens.

f. Install the sterilizable handle.

9. Plug power cable from arm into receptacle on rear of base.

h. Plug line cord into receptacle on rear of base, or connect external 24V battery.

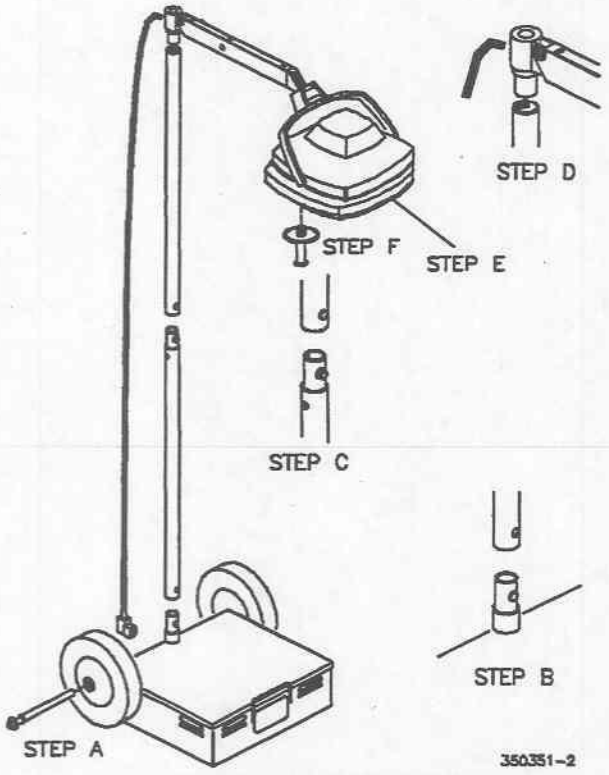


FIGURE 2-2. LIGHT ASSEMBLY

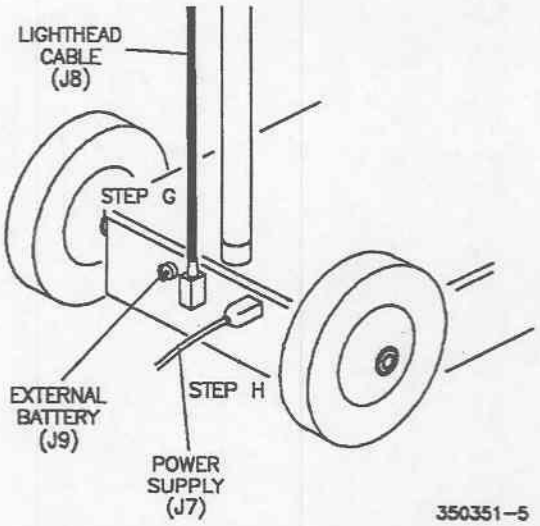


FIGURE 2-3. POWER SUPPLY CONNECTIONS

2-4 CHARGING THE BATTERY

If battery becomes completely discharged, charge it immediately. If light is stored for an extended period of time, remove batteries or charge them every 2 months.

An internal power supply charges the backup batteries whenever the base is plugged into an AC outlet. Maximum charging time is 8 hours to full charge. A voltage sensor will prevent overcharging. It disables the charging circuit when the battery voltage reaches 28 volts.

2-5 FIELD REMOVAL AND PACKING

Disassemble the light and pack as shown in Figure 2-1.

2-6 INSTALLATION CHECK

Performance checks are required to ensure correct operation of the light. These checks and any necessary adjustments should be done by authorized personnel. Refer to Section 7 — Repair for any service corrections.

2-6.1 Optical Safety Check

a. Remove lens cover.

b. Ensure that shipping material has been removed from around blue-green heat filter.

c. Check that heat filter is in place and that three spring wires are in place.

d. Check for dichroic reflector.

e. Replace lens cover.

2-6.2 Functional Check

a. Turn ON light and move the lighthead through its maximum travel at all pivots.

b. If there is excessive drift, refer to Section 5 — Preventive Maintenance.

c. If the light flickers or goes out, refer to Section 6 — Trouble Analysis.

d. Replace bulb if necessary.

e. Unplug line cord from outlet. The light should remain ON.

f. If the light goes out when the line cord is unplugged, recharge the battery.

NOTE

The light will flicker when the power supply switches from line operation to battery operation. This is normal — no corrective action is required.

2-6.3 Optical Performance Check

The light should produce a circular light pattern at 36 inches below the outer edge of the lens cover. The illumination should be 3500 footcandles minimum measured at the center of the pattern.

For corrective action, refer to Section 6 — Trouble Analysis and Section 7 — Repair.

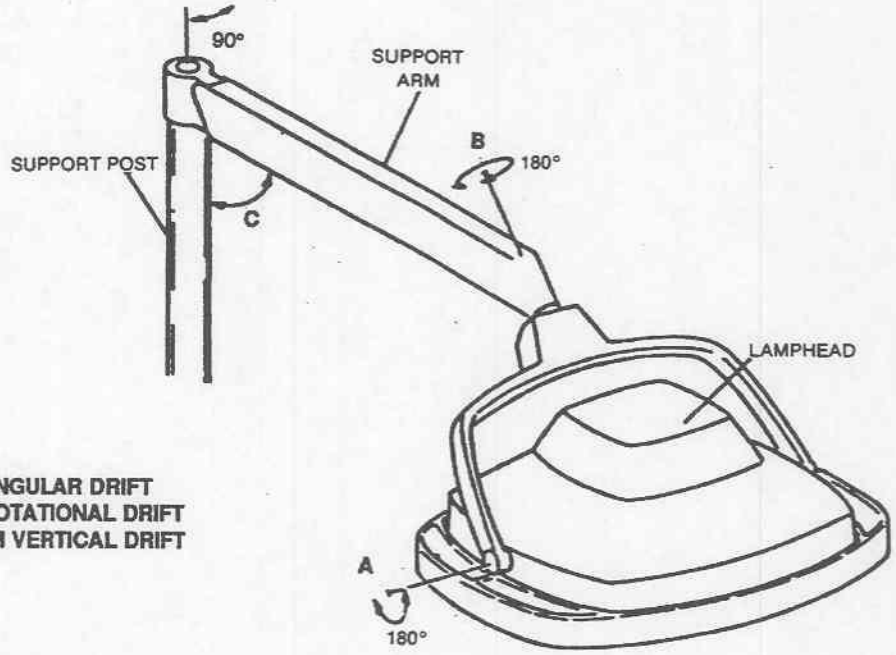


FIGURE 2-4. ROTATIONAL AND ANGULAR MOVEMENTS

OPERATION

3-1 SAFETY PRECAUTIONS

3-1.1 Steps for Safety

WARNING

These steps should be observed for the safety of the patient and operating personnel when using the light. Failure to follow these safety steps could result in injury to the patient and user.

a. Although great emphasis, research, and consideration have gone into the design for safety of this product, abuse or misuse could cause potential unsafe conditions.

b. The doctor or other personnel must move the light out of the way before a patient gets up from the table.

c. Never let a patient use the light as a handle to get up from the table.

d. Never use the light with the lens cover removed or hanging from the retaining strap.

e. Do not lean on the light.

f. Do not lift the lighthead upward with such force that the light tips over.

3-1.2 General Safety Precautions

a. Read all instructions.

b. Do not touch hot surfaces. Use handles.

c. Use close supervision when equipment is used on or near children.

d. Do not operate after equipment malfunctions or has been damaged.

e. Use this equipment only for its intended use, as a surgical light, as described in this manual.

f. Unplug and turn OFF equipment when not in use.

g. Do not use equipment with damaged or broken electrical parts or connectors.

h. The use of any accessory attachments not sold or recommended by Getinge/Castle Inc. may cause hazards.

i. Do not expose electrical components to liquids.

3-2 MOVING THE LIGHT

WARNING

To avoid injury, hold on to the support arm when moving the light.

To move the light, use the support post to tip the front of the base off of the floor. Push or pull the light as you would a hand truck.

Use the handle on the base to carry the light over obstructions. One person should lift the light by the handle, and another person should lift it by the support post.

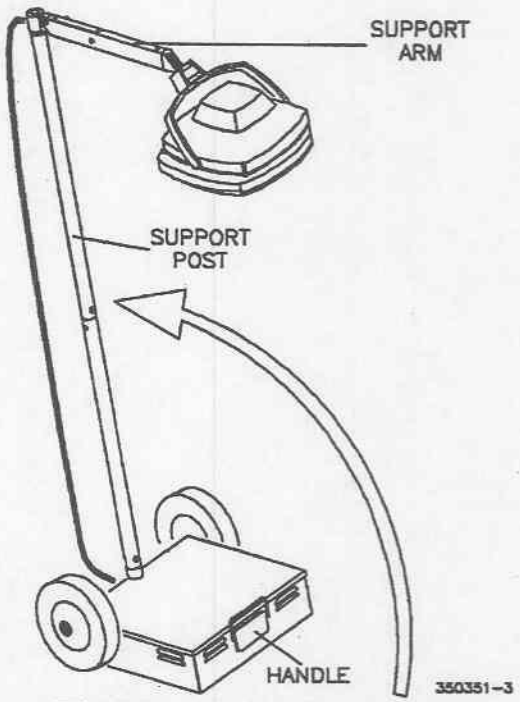


FIGURE 3-1. MOVING THE LIGHT

3-3 LIGHT OPERATION

The Castle 2410MB Surgical Light is not designed to be used in areas where flammable anesthetics may be present.

As in all high intensity lighting systems, a portion of the systems radiant output can cause a temperature increase and subsequent drying. Even though the effect is minimal, the light should be turned off or directed onto another area when not required, especially during lengthy procedures.

a. If AC power will be used, plug the light into a grounded receptacle. If an external battery will be used, remove cap from power receptacle and connect to 24V battery.

b. Attach the sterilizable handle by threading it into the lighthead. Seat the handle firmly in place.

c. Turn ON the light.

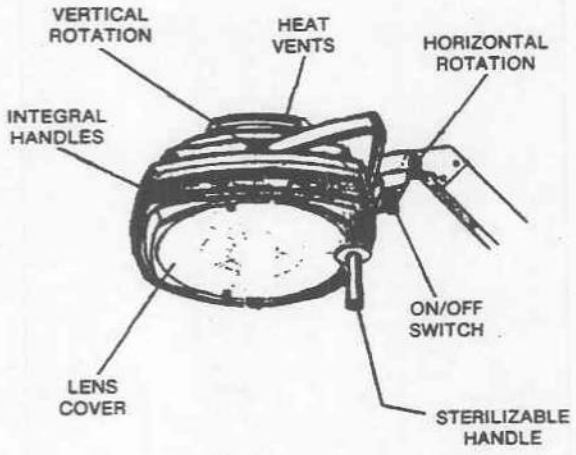


FIGURE 3-2 ON/OFF SWITCH AND HANDLES

d. Adjust angle and position of illumination using integral handles for horizontal and vertical location.

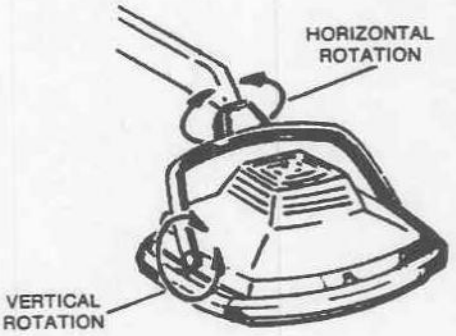


FIGURE 3-3. LIGHTHEAD ADJUSTMENT

e. Critical adjustments can be made with the sterilizable handle by scrubbed personnel.

f. When finished, turn OFF the light and move the lighthead away from the area before the patient sits upright on the table.

THEORY OF OPERATION

4-1 GENERAL DESCRIPTION

4-1.1 Power Supply

The 24 VDC, 2.4 A switching power supply provides power for the light when the light is operated from 115 or 230 VAC, 50 or 60 Hz power source.

The 28 VDC, 3.0 A linear power supply charges the two internal 12V batteries whenever the base is plugged into an AC outlet.

Relay K1 switches the power supply input configuration. K1 is energized whenever 230 VAC primary power is applied.

Relay K2 switches the power supply output, either the 24 VDC switching supply or the backup batteries. K2 is energized whenever the 24 VDC switching supply is operating.

Voltage sensor K3 interrupts the charging circuit when the battery reaches 28 volts. The interrupt is removed when the voltage reaches 24 volts.

41.2 Optical System

The surgical field light uses a 24 volt, 60 watt, tungstenhalogen lamp. The reflector directs a high-intensity pattern onto the patient. A blue-green filter surrounding the light source color-corrects the light and filters heat. A frosted lens diffuses the light beam.

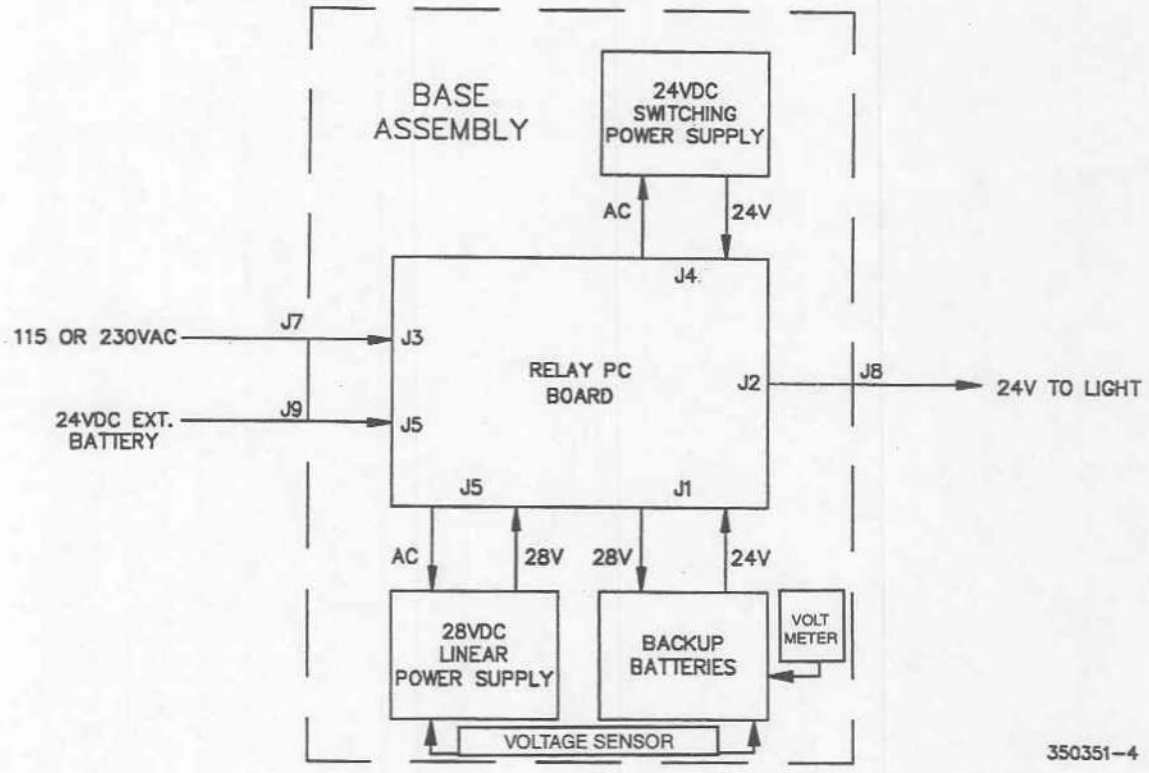


FIGURE 4-1. 2410MB SURGICAL FIELD LIGHT BLOCK DIAGRAM

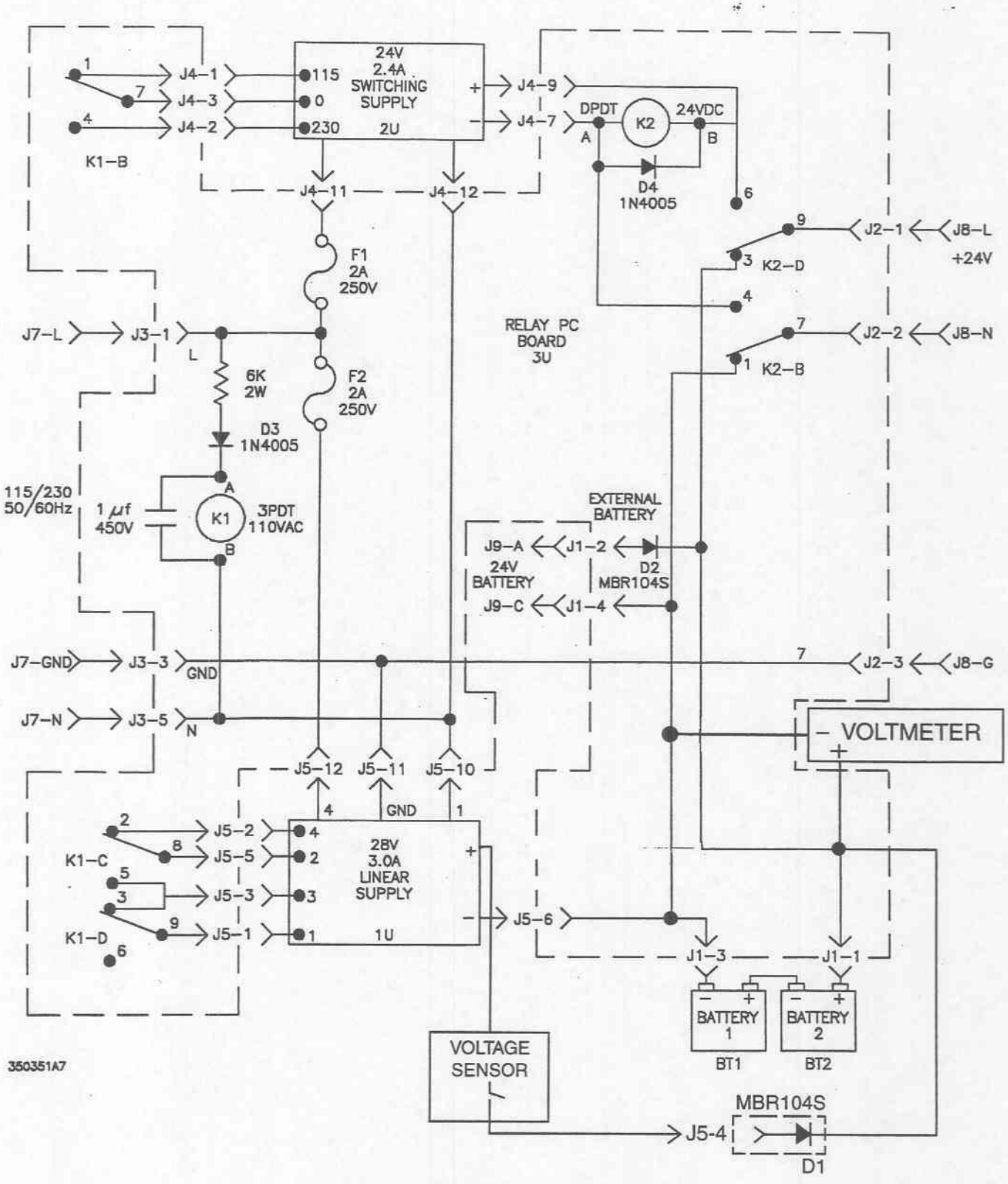


FIGURE 4-2. POWER SUPPLY WIRING DIAGRAM

PREVENTIVE MAINTENANCE

5-1 OPERATOR MAINTENANCE

5-1.1 Cleaning Exterior Surfaces

WARNING

To avoid electrical shock, disconnect or turn off the power source to the light before performing any maintenance or cleaning procedures. Allow the lighthead to cool before touching any internal parts.

Wipe off all exterior surfaces with a soft cloth dampened with a mild cleaning agent that will not damage painted, plated, or plastic surfaces.

5-1.2 Cleaning Optical Surfaces

WARNING

Handle all optical surfaces (lens, cover, heat filter, and reflector) with extreme care. Clean only when required due to dust or smudges.

a. Loosen thumbscrews and lower the lens. The lens will be suspended by a retaining strap.

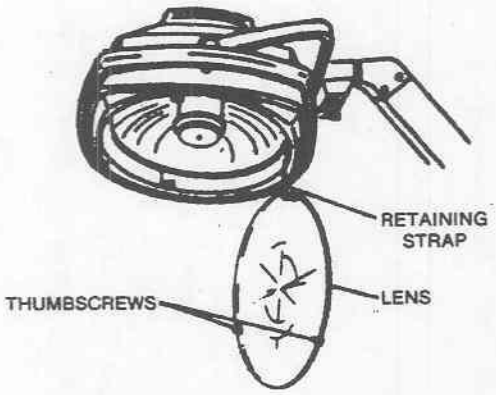


FIGURE 5-1. LOWERING LENS COVER

b. Gently clean inside of reflector with cotton dampened with surface disinfectant. The cotton will conform to the contour of the reflector. Clean in direction of flutes. Wipe dry with a fresh piece of cotton.

c. Clean the outside of the blue-green heat filter in the same manner.

CAUTION

Do not use acid solutions, including chlorinated cleaners. Do not use any scrubbing or abrasive action to avoid damage to the reflector coating.

The water should be deionized or distilled.

d. Gently clean both surfaces of the lens with cotton dampened with surface disinfectant. Wipe dry with fresh cotton.

WARNING

The blue-green heat filter and lens must be in place to prevent ultraviolet and infrared rays from reaching the patient or operator.

NOTE

The lens has a center fusion spot. This is on the inside surface.

e. Re-install the lens.

5-1.3 Replacing Bulb

Disconnect or turn off the power source to the light before performing any maintenance. Allow the lighthead to cool before touching any internal parts.

a. Loosen lens thumbscrews. The lens will hang from a retaining strap.

b. Position the lighthead at a little above eye level.

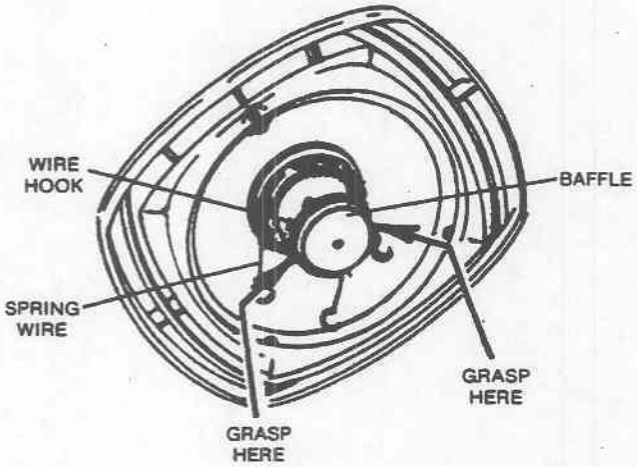


FIGURE 5-2. REMOVING HEAT FILTER

c. Snap out the battle assembly form the heat filter assembly and access the bulb by reaching through the cylinder.

d. Remove the heat filter/battle assembly as shown. Avoid touching the blue-green glass.

Read handling note printed on wrapper of new bulb.

Skin oils will damage and shorten life of bulb. If accidentally touched, wipe bulb with alcohol or distilled water.

f. Hold new bulb by wrapper and insert in socket.

g. Press down and turn clockwise to insert.

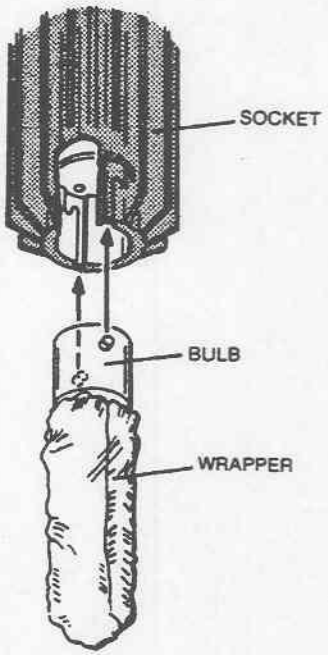


FIGURE 5-3. INSERTING THE BULB

h. Clean inside and outside of blue-gree heat filter with cotton dampened with surface disinfectant, then rinse with cotton dampened with deionlzed or distilled water.

The blue-gree heat filter and lens must be in place to prevent ultraviolet and infrared rays from reaching the patient or operator.

i. Re-install the heat filter/baffle assembly in the upper recessed area. Attach the spring wires and lens.

5-1.4 Replacing Heat Filter

WARNING

Turn OFF the light before performing any maintenance. Allow a 15 minute cool-off period to avoid touching hot lighthead parts.

a. Loosen the lens thumbscrews. The lens will hang from a retaining strap.

b. Position the lighthead at a little above eye level.

c. Unhook the three heat filter spring wires.

d. Remove the blue-green heat filter/baffle assembly for bench work.

e. Remove filter clips and replace heat filter. The heat filter will fit around the light shield.

NOTE

The heat filter is cone shaped. Assemble the larger diameter into the baffle assembly.

f. Replace filter clips. Tighten screws until clips are snug. Do not over tighten.

9. Clean inside and outside of blue-green heat filter with cotton dampened with TEC SURF, then rinse with cotton dampened with deionized or distilled water.

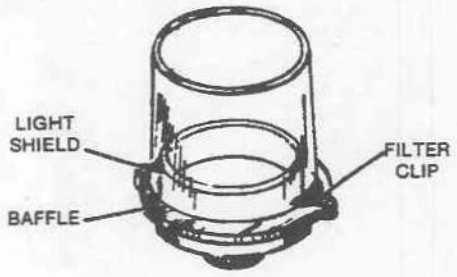
h. Replace heat filter assembly, spring wires, and lens.

WARNING

The blue-green heat filter and the lens must be in place to prevent unfiltered rays from reaching the operator or patient.

NOTE

Be sure that the heat filter is positioned in the upper recessed area.



5-1.5 REPLACING FUSE

5-1.5 Replacing Fuse

Replace fuses on PC board with 2A, 250V Slow-Blow fuses (Bussman MDA Series).

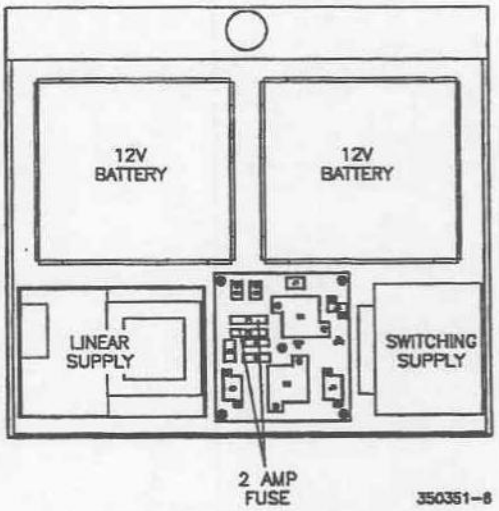


FIGURE 5-5. REPLACING FUSE

5-2 MECHANICAL ADJUSTMENTS

These instructions include all the adjustments provided to correct drift of the light. Refer to Figure 5-6 for light components, location of adjustments, and angular limitations.

Detailed instructions for removing and replacing some covers, such as the lighthead cover, are located in Section 7 — Repair.

Each movement is divided into check and adjustment steps. Always do the check step first. If the particular movement does not meet the requirements of the check, then proceed with the adjustment steps.

NOTE

Adjustments A thru C should not be required on newly installed equipment. Make the adjustment only if there is a definite rotational drift. There should be free movement of the arm but no drift.

5-2.1 Tools and Test Equipment

All adjustments can be made using common hand tools. No test equipment is required.

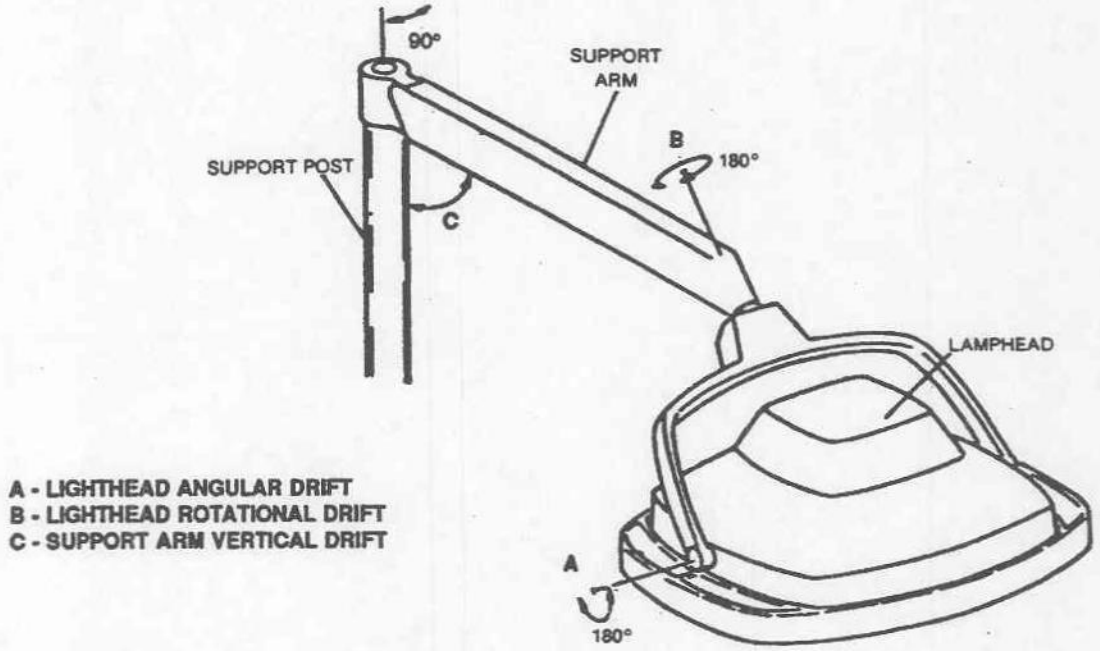


FIGURE 5-6. ROTATIONAL AND ANGULAR MOVEMENTS

5-2.2 Lighthead Angular Drift (Adjustment A)

Correct lighthead drift in the angular plane by increasing tension on the yoke pivot spring washer.

Check

a. Rotate the lighthead up and down about its axis.

b. Lighthead movement should stop when the integral handle is released at any point in the vertical travel.

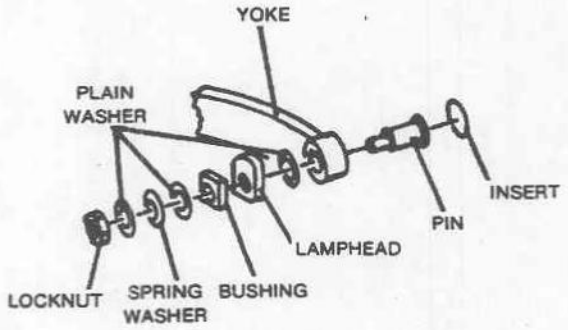


FIGURE 5-7. LIGHT PIVOT ADJUSTMENT

Adjustment

c. Remove the lighthead cover (see paragraph 7-2). Adjustment is made on the right hand pivot.

d. Tighten locknut until angular drift is just eliminated.

e. Recheck for angular drift.

f. Replace cover.

5-2.3 Lighthead Rotational Drift (Adjustment B)

Correct lighthead drift in the rotational plane by increasing tension on the yoke mounting spring washer.

Check

a. Rotate the lighthead around the axis of the support arm.

b. Lighthead movement should stop when the integral handle is released at any point in the yoke rotation.

Adjustment

c. Remove the lighthead switch cover.

d. Break loctite and remove lighthead set screw.

e. Break loctite and back off yoke pin about 1/6 inch using an open end wrench.

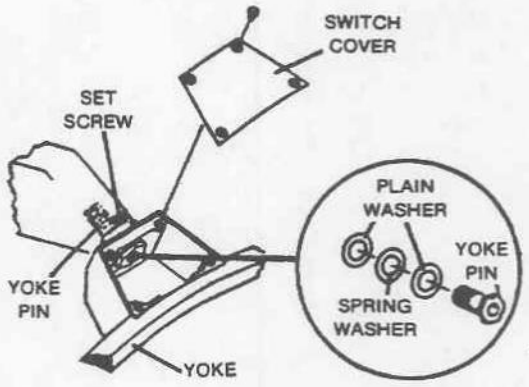


FIGURE 5-8. YOKE PIVOT ADJUSTMENT

f. Tighten yoke pin until rotational drift is eliminated.

g. Apply loctite and tighten lighthead set screw.

h. Check again for rotational drift.

i. Replace switch cover.

5-2.4 Support Arm Vertical Drift (AdJustment C)

Correct lighthead drift in the vertical plane by increasing tension on the support pivot spring washers.

Check

a. Move the support arm up and down using the integral handles.

b. Lighthead movement should stop when the handle is released at any point in vertical travel.

Adjustment

c. Tighten friction adjustment screws equally until vertical drift is eliminated.

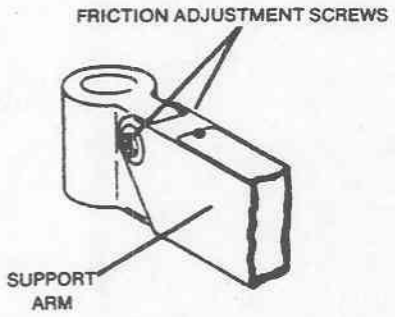


FIGURE 5-9. VERTICAL ADJUSTMENT

NOTE

If the support arm still drifts after adjusting the tension, replace the gas spring (see paragraph 7-7).

5-3 POWER SUPPLY CALIBRATION

WARNING

To avoid electrical shock, use caution when making power supply adjustments. Disconnect line cord before connecting test equipment. Use an insulated adjustment tool to avoid contact with power supply components.

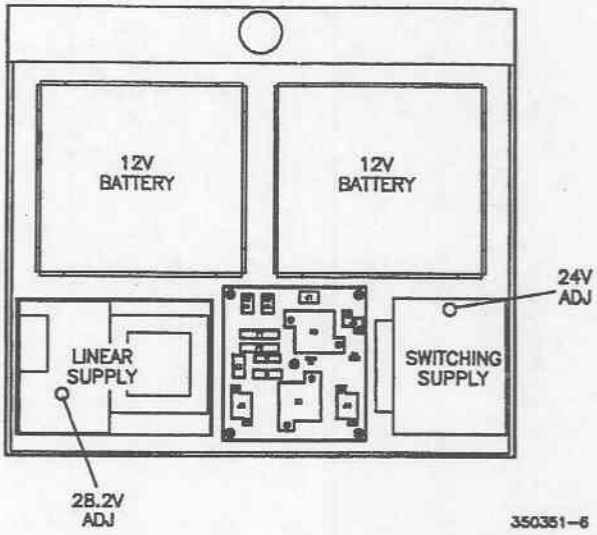


FIGURE 5-10. POWER SUPPLY ADJUSTMENTS

5-3.1 Tools and Test Equipment

A digital voltmeter is required for power supply calibration.

5-3.2 24 VDC Switching Power Supply

a. Disconnect the line cord.

b. Remove the base assembly cover.

c. Disconnect P2 from J2.

d. Connect (+) lead of voltmeter to J2-1 and (-) lead to J2-2.

e. Reconnect the line cord.

f. Adjust 24V switching power supply for 24.67 ± 0.010 VDC.

5-3.4 Voltage Sensor

a. Disconnect the line cord.

b. Remove the base assembly cover.

c. Disconnect the sensor harness DC input leads from the battery terminals. Note polarity.

d. Connect DC input leads to an external DC power supply.

e. Turn the pickup knob 1/4 turn clockwise from full counter-clockwise.

f. Turn the dropout knob 1/2 turn clockwise from full-counter-clockwise.

g. Slowly increase the power supply voltage until a click is heard from the sensor. Note voltage.

h. Slowly decrease the power supply voltage until a second click is heard. Note voltage.

i. Adjust knobs as required to set the pickup voltage to 28 volts and the dropout voltage to 24 volts.

j. Reseal knobs with silicone sealant.

5-3.3 28 VDC Linear Power Supply

a. Disconnect the line cord.

b. Remove the base assembly cover.

c. Disconnect P1 from J1.

d. Connect (+) lead of voltmeter to J1-1. Connect (-) lead to J1-4.

e. Reconnect the line cord.

f. Adjust 28V linear power supply for +28.2±0.1 VDC (no load condition).

5-4 RECOMMENDED SPARE PARTS

It is recommended that the parts listed below be maintained in stock to ensure availability when needed.

QTY.	PART NO.	DESCRIPTION
2	516767	Bulb, Tungsten Halogen (24V - 60W)
2	516768	Cylinder, Glass Heat Filter
2	87756	Fuse, 2 AMP, 250V (Bussman MDA Series)
1	65196	Handle, Sterilizable

TROUBLE ANALYSIS

6-1 LIGHT PERFORMANCE CHECK

Performance checks are required to ensure correct operation of the light. These checks and any necessary adjustments should be done by authorized personnel. Refer to Section 2-Installation for check procedures, and Section 7-Repair for any service corrections.

6-2 TROUBLE ANALYSIS GUIDE

Several of these checks are made with the power ON Only trained service personnel should make these tests.

6-2.1 Trouble Analysis Guide - Electrical and Optical

TROUBLE	PROBABLE CAUSE	REMEDY
ON/OFF Switch ON, light out (AC Operation)	Bulb out Fuse blown. Harness J2/JB disconnected.	Replace bulb. Replace fuse. Connect harness
ON/OFF Switch ON, light out. (DC Operation)	Bulb out. Battery missing or not charged. Harness J2/J8 disconnected. J1 on Relay PC Board disconnected	Replace bulb. Check battery/recharge. Connected harness Check battery connections.
Low light intensity. (AC operation)	Dirty lens or reflectors Damaged reflectors or lens. Bulb defective. 24V supply out of adjustment or defective. Poor connection at J2/J8.	Clean or replace. Refer to Section 5 — Maintenance for suggested procedure. Replace defective part. Replace bulb. Adjust or repair. Reconnect harness.
Low light intensity. (DC Operation)	Dirty lens or reflectors. Damaged reflectors or lens. Bulb defective. Battery voltage low. 28V supply out of adjustment or defective. Poor connection at J2/J8.	Clean or replace. Refer to Section 5 — Maintenance for suggested procedure. Replace defective part. Replace bulb. Charge battery. Adjust or repair. Reconnect harness.
Intermittent illumination when pivoting arms.	Loose wire connections, frayed or broken wires. Defective bulb.	Check wiring for continuity. Replace bulb.
Light flickers.	Power supply has switched over from line voltage to battery operation. Loose connection.	This condition is normal—no corrective action required. Check wiring for continuity.

6-2.2 Trouble Analysis Guide - Electrical and Optical

TROUBLE	PROBABLE CAUSE	REMEDY
Lighthead drifts in angular plane.	Yoke pivot out of adjustment.	Adjust tension on yoke pivot spring washer — Adjustment A.
Lighthead drifts in rotational plane.	Yoke mounting pivot out of adjustment.	Adjust tension on yoke spring washer — Adjustment B.
Vertical drift in support arm.	Support arm pivot out of adjustment.	Adjust tension on support arm washers — Adjustment C. If arm still drifts, replace gas spring.

REPAIR

7-1 WARNINGS

To avoid electrical shock, disconnect or turn off the power source to the light before performing any maintenance or repair procedures. Allow the lighthead to cool before touching any internal parts.

After any service work, the blue-green heat filter and the lens cover must be re-installed in place to prevent ultraviolet and infrared rays from reaching the patient or operator.

7-2 REMOVING LIGHTHEAD COVER

Loosen four screws and remove the lighthead cover from the lighthead housing. To replace cover, rotate housing away from yoke.

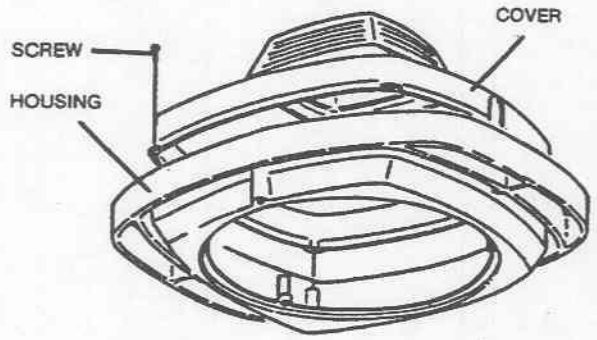


FIGURE 7-1. REMOVING LIGHTHEAD COVER

7-3 REPLACING ON/OFF SWITCH

a. Observe the switch orientation. OFF is toward the left of the nameplate.

b. Remove switch cover. Disconnect and prevent ends of wires from retracting into arm or yoke.

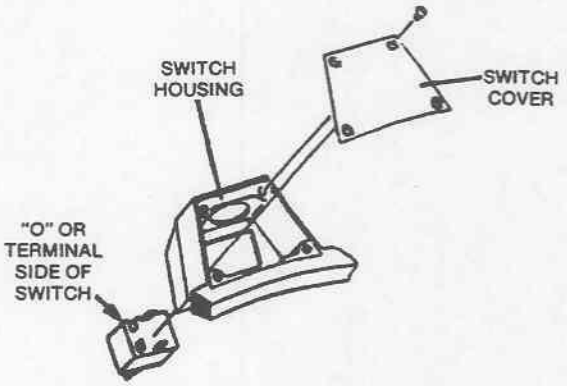


FIGURE 7-2 ON/OFF SWITCH ORIENTATION

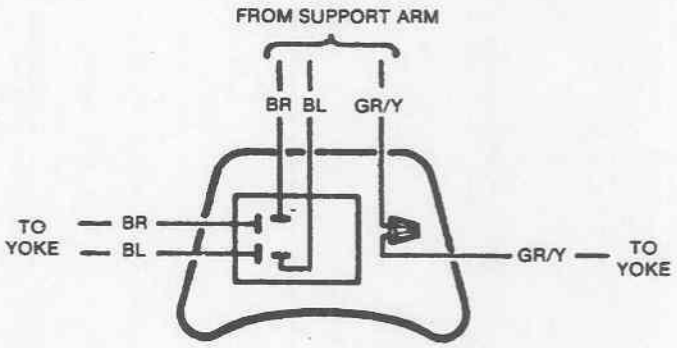


FIGURE 7-3. LIGHTHEAD CONNECTIONS

c. Press down on terminal surface of switch to remove from housing.

d. Install new switch in housing with terminals and OFF indication toward left.

e. Rewire switch and check for correct operation.

f. Replace switch cover.

7-4 REPLACING LAMP CONTACT

WARNING

To avoid electrical shock, disconnect or turn off power to the light before performaning any maintenance or repair procedures.

NOTE

Use repair package 67501 for this procedure. Package consists of the contact with wiring, retaining ring, two flag terminals, and sleeving.

a. Remove the lighthead and support arm from the support post.

b. Remove lens, heat filter, back cover, and lamp.

c. Disconnect ground wire from heat dissipation plate.

d. Remove cable clamp from heat dissipation plate.

e. Disconnect lighthead wires from ON/OFF toggle switch. Cut flag terminals from wires.

f. Lift gasket from yoke to expose contact wires. Lift wires from yoke.

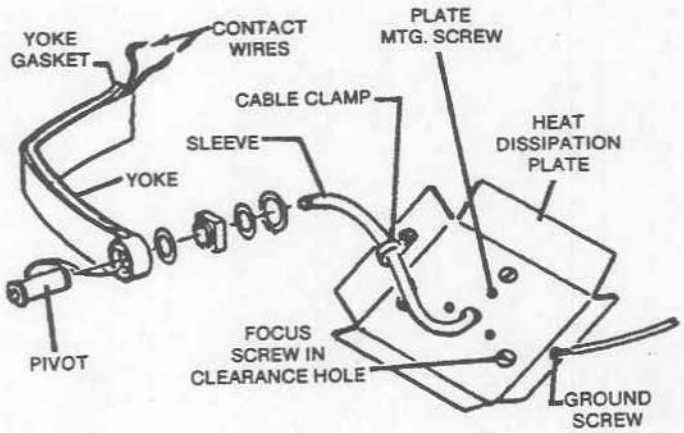


FIGURE 7-4. LAMP CONTACT WIRING

g. Remove three plate mounting screws and guide heat plate along the sleeve. Do not move or adjust focus screws at this time.

h. Insert a small screwdriver blade between the external teeth of the contact retaining ring to pry it loose from the finned heat sink. The retaining ring will be destroyed.

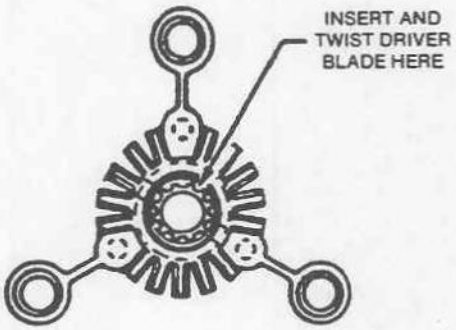


FIGURE 7-5. DISLODGING RETAINING RING

i. Attach a fish wire to the cut ends of the contact wires and tape. Pull old wires through pivot and sleeve.

NOTE

Correct lamp contact orientation must be made. Observe that there are four internal slots in the finned heat sink. Use only the narrow slots for the lamp contact.

j. Install new contact into finned heat sink casting. Guide socket lugs into narrow slots, 90° apart.

k. Thread new leads through new retaining ring and spring.

l. Use a screwdriver blade to install new retaining ring. Ring must be seated against bottom of casting. Check spring tension on lamp contact. Check lamp fit and orientation of contacts before reassembling.

m. Guide new contact wires through sleeve and pivot.

CAUTION

Check that wire insulation is not frayed or torn.

n. Align wires along yoke gasket groove and into switch cavity. Lay wires into groove one at a time.

o. Form gasket into groove to the correct length.

p. Refer to Figure 7-3. Crimp new flag terminals onto wires and connect to ON/OFF switch.

CAUTION

The wiring must be contained in the sleeve and the sleeve in place to maintain integrity of codes and regulatory commission mandates.

q. Reconnect ground wire securely. Reassemble cable clamp. Replace heat plate and lamp.

r. Turn ON power and check operation of lamp and switch.

s. Turn OFF power to light.

t. Replace all lighthead parts in reverse order.

7-5 REPLACING REFLECTOR

WARNING

Disconnect or turn off power source to the light before any maintenance to avoid hazardous electrical contact. Allow a 15 minute cool-off period to avoid touching hot lighthead parts.

a. Remove lens, lighthead cover, and heat sink.

b. Remove ground wire from heat plate.

c. Remove four screws, nuts, and washers to lift reflector heat sink assembly form the reflector.

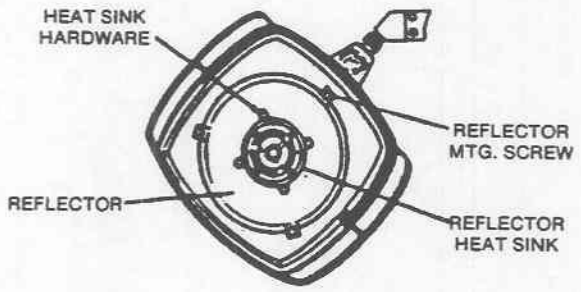


FIGURE 7-6. REPLACING REFLECTOR

d. Remove three screws and lift old reflector from housing.

e. Install new reflector and reassemble lighthead in reverse order of disassembly. Refer to Figure 7-7 for orientation of components.

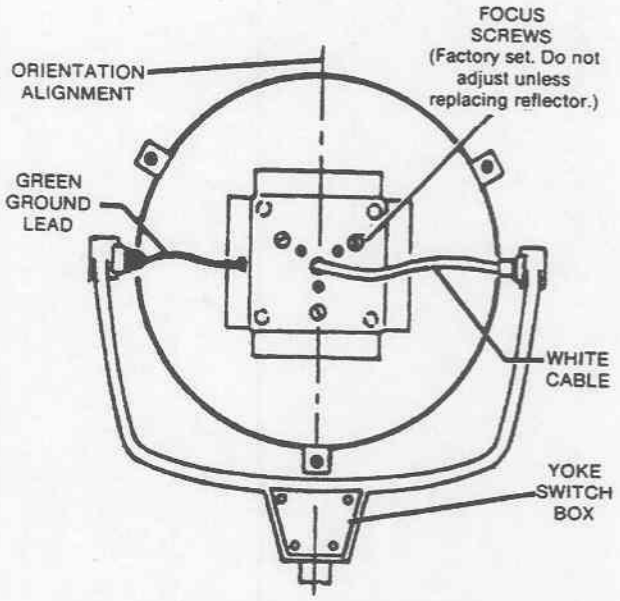

FOCUS SCREWS (Factory set. Do not adjust unless replacing reflector.)
ORIENTATION ALIGNMENT
GREEN GROUND LEAD
WHITE CABLE
YOKE SWITCH BOX

FIGURE 7-7. REFLECTOR ORIENTATION

7-6 ADJUSTING LAMP FOCUS

Lamp focus is factory set, but can be adjusted if required. Position lighthead 36" from and parallel to the illuminated surface. Using a light meter, adjust focus screws to achieve maximum illumination consistent with a uniform round pattern.

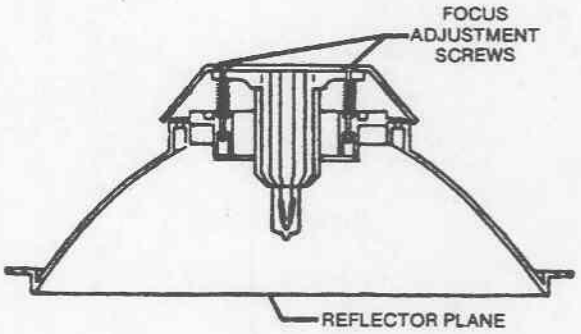


FIGURE 7-8. LAMP FOCUS

a. Place the meter at the center of the pattern. Measure the illumination at the center.

b. Move the meter out from the center on the A axis until you obtain a reading of 20% of the center reading. Record this radius.

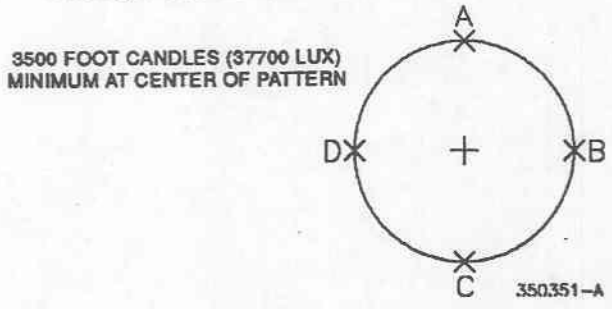


FIGURE 7-9. FOCUS PATTERN

c. Repeat step b for points B, C, and D.

d. Adjust the focus adjustment screws so that all four radii are equal length.

7-7 REPLACING GAS SPRING

To avoid electrical shock, disconnect or turn off power to the light before forming any maintenance or repair procedures.

a. Secure the lighthead and support arm in the up position.

b. Remove the upper and lower access covers.

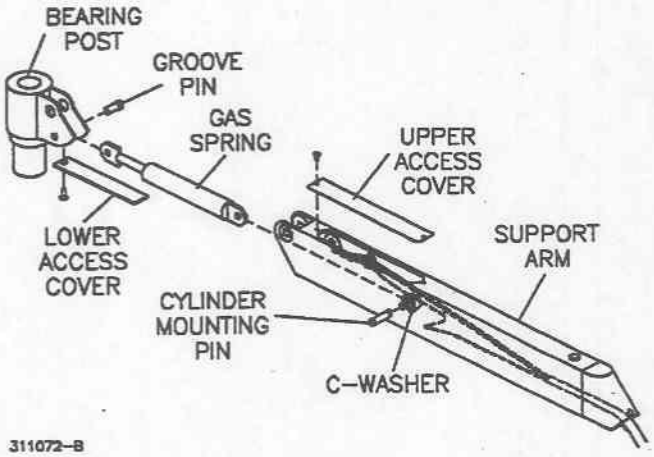


FIGURE 7-10. REPLACING GAS SPRING

c. Remove the C-washer from the spring mounting pin.

d. Gently wiggle the support arm upward to slide the pin from the support arm. The end of the gas spring will move into the upper recess area.

e. Snug the electrical wires to the side of and under the gas spring.

f. Guide the gas spring through the upper access opening as the support arm is slowly lowered.

g. Note that one end of the groove pin is smaller. Drive groove pin out from the smaller end.

h. Lift the old gas spring out of the arm.

i. Place the new spring into the arm with the rod or stop end toward the bearing post and with the end lugs vertical.

j. Guide the groove pin through the arm and the spring with the electrical wires over the pin. Rotate the flutes on the groove pin to form new grooves in the housing. Drive the pin flush with the surface of the housing.

The electrical wires must be routed above the groove pin, spring, and spring mounting pin to prevent the motion of the spring from cutting the wires.

k. Raise the lighthead until the spring mounting shoulder pin can be installed. Install the pin below the three electrical wires. Add C washer to retain pin.

l. Replace the upper and lower access covers.

m. Refer to Adjustment C in Section 5 to correct any support arm vertical drift.

7-8 REMOVING LIGHTHEAD/YOKE ASSEMBLY

a. Remove the lighthead switch cover.

Secure wires from lighthead and from support arm to avoid wire ends slipping into castings.

b. Disconnect ground line wire nut.

c. Disconnect wires from ON/OFF switch.

d. Break loctite and loosen lighthead set screw.

The support arm will spring upward when the lighthead is removed. Secure arm to prevent pivot movement.

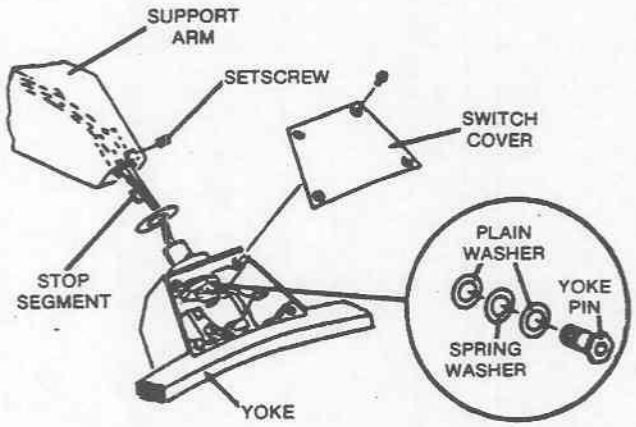


FIGURE 7-11. REMOVING LIGHTHEAD/YOKE

e. Remove yoke pin and stop segment. Separate lighthead from support arm.

f. Cut flag terminals from yoke wires.

Stop segment must be in place to prevent over rotation of yoke and lighthead.

9. Replace lighthead in reverse order of removal. Refer to figure 7-11 for placement of spring washer.

h. Refer to Adjustment B in Section 5 to correct any lighthead rotational drift.

i. Reconnect wires to ON/OFF switch. Refer to figure 7-3.

j. Check lighthead for correct operation and rotation.

PARTS LIST

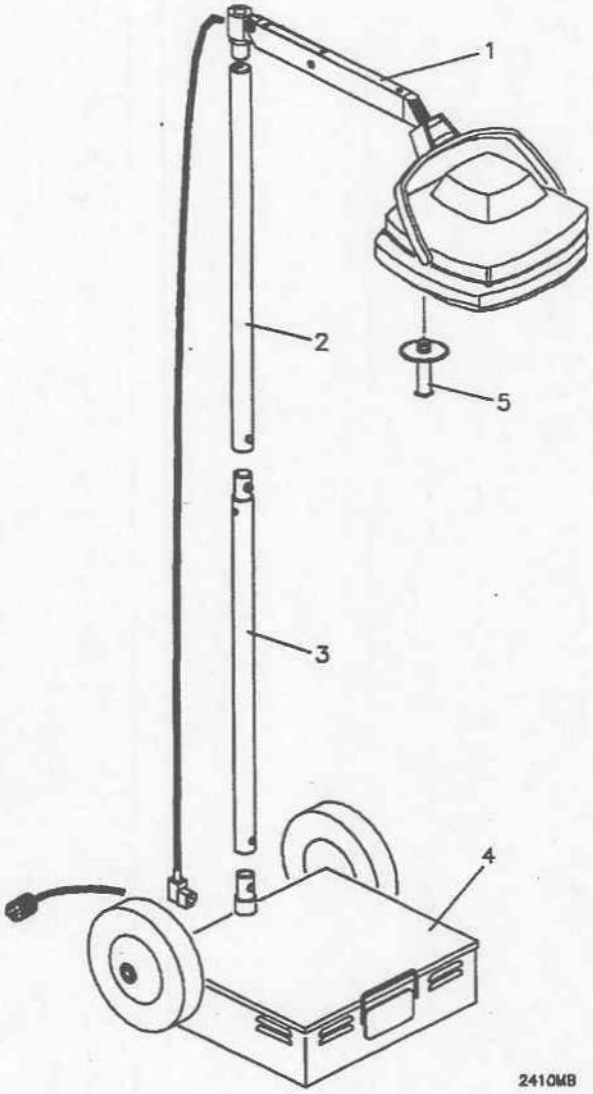


FIGURE 8-1. CASTLE 2410MB SURGICAL FIELD LIGHT

Castle 2410MB Surgical Field Light — Refer to Figure 8-1

ITEM	PART NO.	DESCRIPTION
1	311072	Counterbalance Arm and Light Assembly • See Figure 8-2 for listing of parts
2	301745	Post, Upper Floor Stand
3	301746	Post, Lower Floor Stand • See Figure 8-5 for listing of parts
4	311073	Base Assembly • See Figure 8-6 for listing of parts
5	65196	Sterilizable Handles
—	311095	Shipping case, reusable

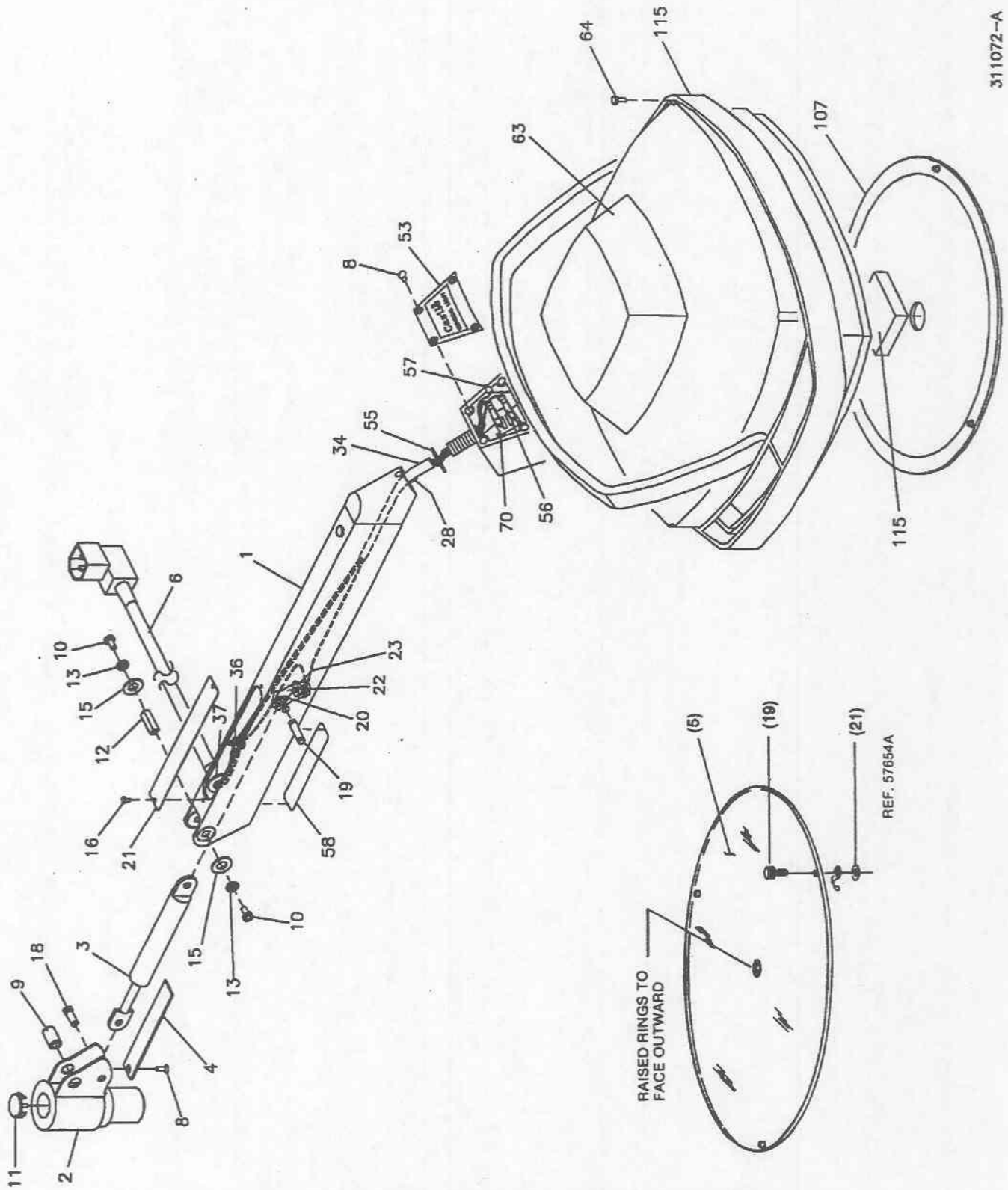


FIGURE 8-2. COUNTERBALANCE ARM AND LIGHT ASSEMBLY

Counterbalance Arm and Light Assembly — Refer to Figure 8-2

ITEM	PART NO.	DESCRIPTION
1	311071	Arm, Counterbalance
2	65091	Mount, Counterbalance Arm
3	65024S	Spring, Gas
4	65028	Cover, Pivot Access
6	311067	Cord, Floor Stand to Lighthead
8	E6876	Screw, #6-32 x 5/16 S-Tapping Phillips Oval Head (Black)
9	65038	Bushing, Arm Pivot
10	25191	Screw, #10-32 x 3/8 Hex Socket Button Head
11	65060	Button, Plug for 11 /16 dia Hole
12	65074	Pin, Arm Pivot
13	65075	Bushing, Trim
15	65080	Washer, 3/8 Spring
16	E6884	Screw, #4-40 x 3/16 S-Tapping Phillips Pan Head (Black)
18	E6875	Pin, Groove, 1/4 dia x 3/4 long
19	65163	Pin, Spring Mounting (Black)
20	E2042	Ring, Retaining for 1/4 dia Shaft
21	65145	Cover, Gas Spring Access
22	E2044	Washer, #10 Internal Tooth Lock
23	E6886	Nut, #10-32 Hex Ground (Green)
28	67484	Stop, Yoke Rotation
34	R1922	Tubing, Plastic (specify length)
36	45572	Tie, Cable
37	86949	Bushing, Strain Relief
52	311091	Lighthead Assembly • See Figure 8-3 for listing of parts
53	65175	Cover, Switch
55	65026	Washer, Keyed
56	65199	Terminal, Female Slip-On Flag
57	B0105	Nut, Wire (Two #18 Min - Two #16 Max)
58	65141	Decal, Danger, Explosion Hazard
63	513915	Cover, Lighthead
64	E6333	Screw, #6-32 x 3/8 Hex Socket Head
70	65137	Switch, ON/OFF Rocker
107	67580	Lens Package (includes 1 Lens, 3 Thumbscrews & 3 Retaining Rings)
(5)	65014	• Lens, Diffusion
(19)	65040	• Screw, #8-32 x 3/8 Lens Retaining Thumbscrew
(21)	E6290	• Ring, External Retaining for #8 dia Shaft
115	67487	Pad, Foam Protective (shipping only)
—	30736	Tag, Caution

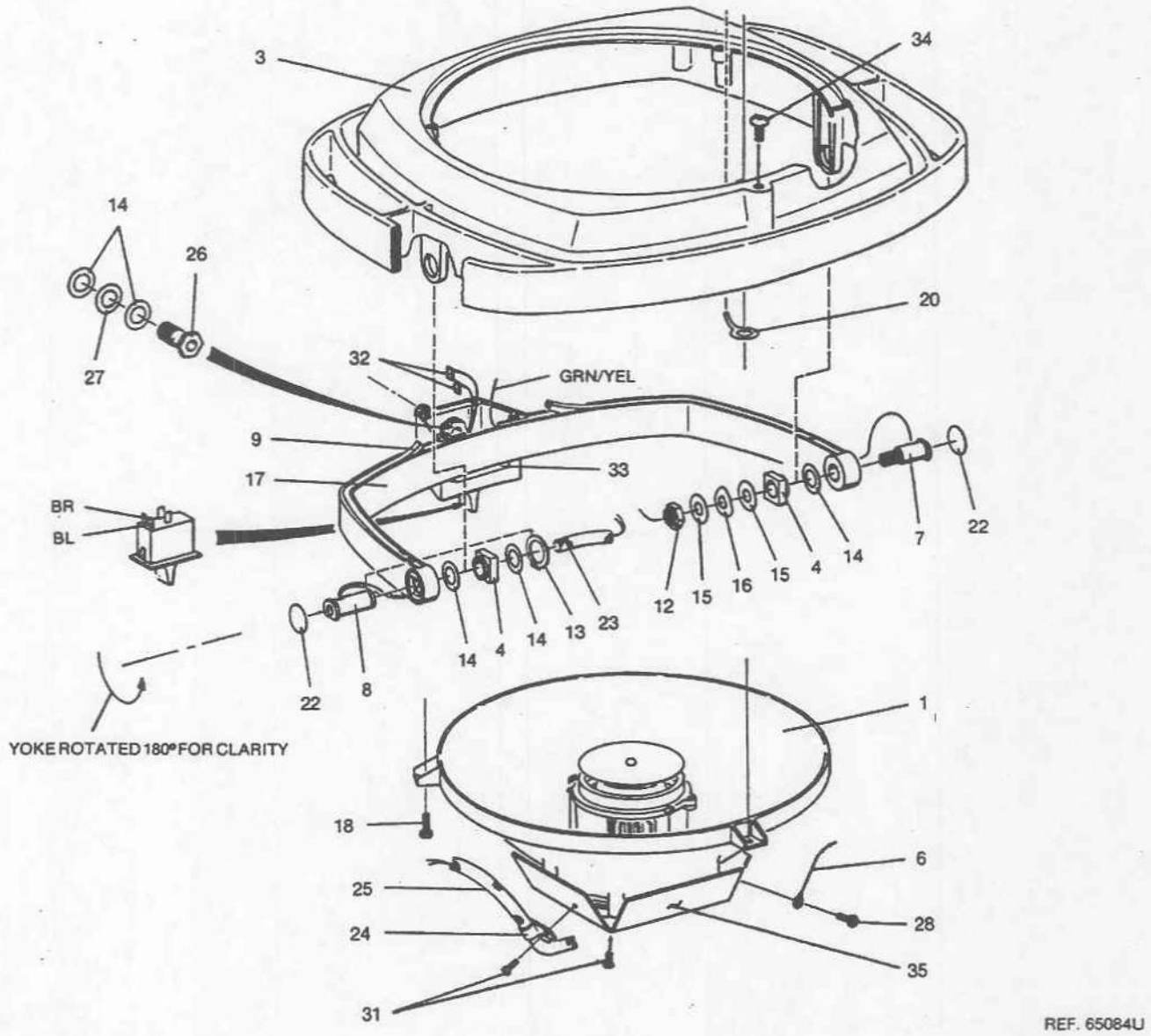


FIGURE 8-3. LIGHTHEAD ASSEMBLY

Lighthead Assembly — Refer to Figure 8-3

ITEM	PART NO.	DESCRIPTION
1	311090	Reflector Assembly • See Figure 8-4 for listing of parts
3	513916	Housing, Lighthead
4	65001	Bushing, Lighthead Pivot
6	65088	Wire Assembly, Ground
7	65031	Pin, Lighthead Pivot (Ground Wire)
8	65000	Pin, Lighthead Pivot (Lamp Wires)
9	65063	Strip, Yoke Gasket
12	E6877	Nut, 3/8-24 Lock
13	E6894	Ring, Retaining for 1 /2 dia Shaft
14	E5325	Washer,1/2 Flat
15	E0245	Washer, 3/8 Flat
16	E0188	Washer, 3/8 Spring
17	65134	Yoke, Lighthead Mounting
18	E4821	Screw, #10 x 1/2 Self-Tapping Phillips Pan Head (Chrome)
20	65039	Strap, Lens Retaining
22	65045	Insert, Pivot Pin Trim
23	33511	Tie, Cable
24	43399	Clamp, 3/16 dia Cable
25	R3278	Tubing, Plastic (specify length)
26	65030	Pin, Yoke Pivot
27	E2002	Washer,1/2 Spring
28	E6645	Screw, #10-32 x 3/8 Hex Head Ground
31	E5025	Screw, #8-32 x 5/16 Phillips Pan Head
32	65199	Terminal, Female Slip-On Flag
33	65198	Bumper, Stop
34	E6342	Screw, 5/16-18 x 1/2 Hex Socket Button Head
35	65019	Plate, Heat Dissipation

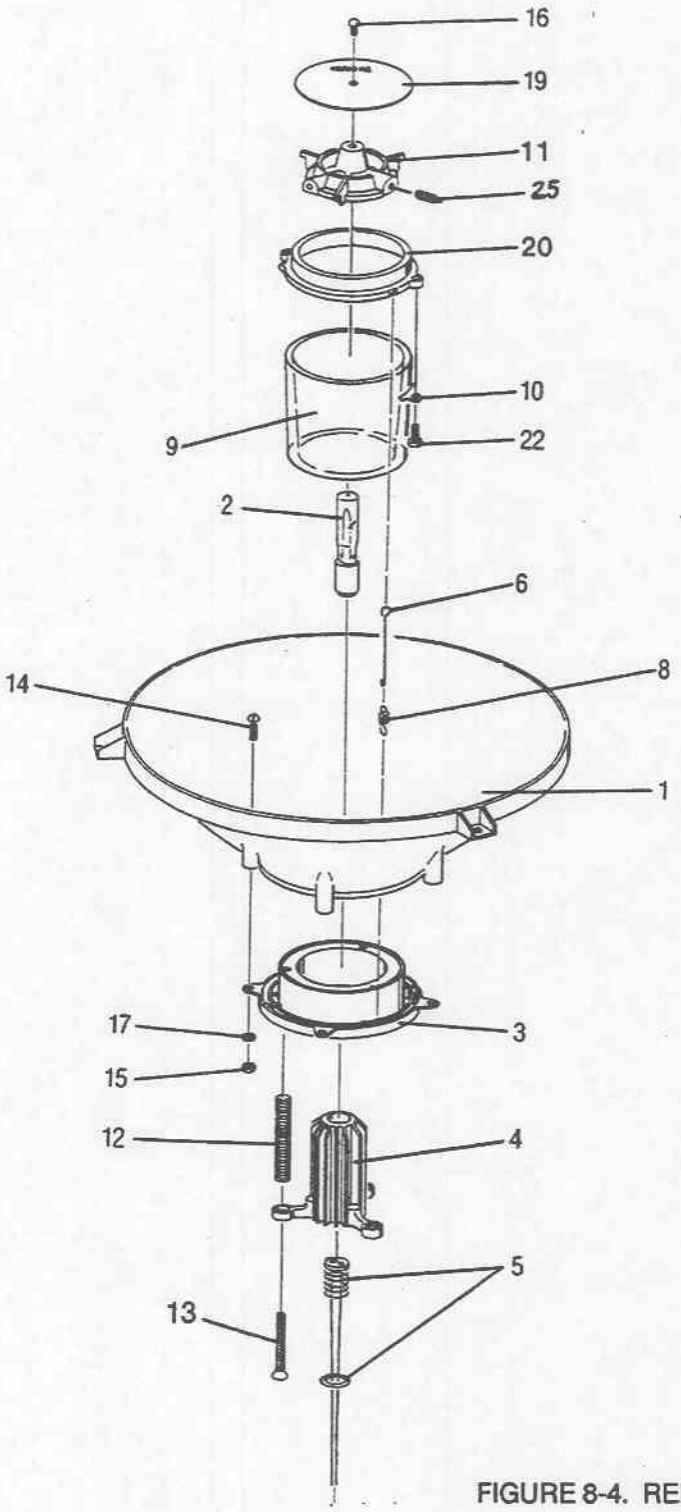


FIGURE 8-4. REFLECTOR ASSEMBLY

Reflector Assembly — Refer to Figure 8-4

ITEM	PART NO.	DESCRIPTION
1	516766	Reflector, Surgical Light
2	516767	Bulb, Tungsten Halogen (24V - 60W)
3	65004	Heat Sink, Reflector Mounting
4	65003	Heat Sink, Bulb Socket
5	67501	Bulb Socket Package
6	65032	Hook, Baffle Retaining
8	65064	Spring, Extension,1/4 dia x 5/8 long
9	516768	Cylinder, Glass Heat Filter
10	65065	Clip, Glass Heat Filter Retaining
11	516770	Baffle, Glass Heat Filter Bottom
12	65062	Spring, Compression, 23/64 dia x 2 long
13	E6567	Screw, #1 0-32 x 1 -1/2 Phillips Flat Head
14	E5015	Screw, #6-32 x 1/2 Phillips Pan Head
15	E5180	Nut, #6-32 Hex
16	E2194	Screw, #6-32 x 1/4 Self-Tapping Phillips Pan Head (Chrome)
17	E4788	Washer, #6 Helical Spring Lock
19	516771	Disc, Baffle, 24V-60W Bulb
20	516769	Ring, Heat Cylinder Bottom
22	E2169	Screw, #6-32 x 3/8 Self-Tapping Phillips Pan Head
25	517088	Plunger, Ball

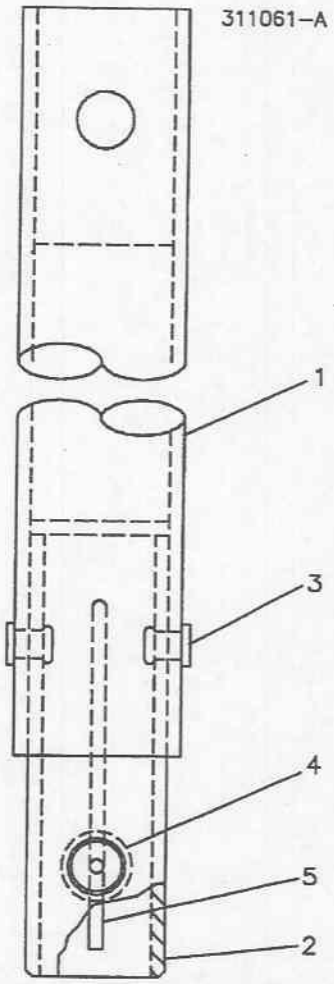


FIGURE 8-5. LOWER FLOOR STAND POST ASSEMBLY

Lower Floor Stand Post — Refer to Figure 8-5

ITEM	PART NO.	DESCRIPTION
1	311060	Post, Lower Floor Stand
2	311063	Coupling, Floor Stand Post
3	E6956	Rivet, 1/4 x 1/2 long Blind
4	311064	Button, Post Release
5	311065	Spring, Post Release Button

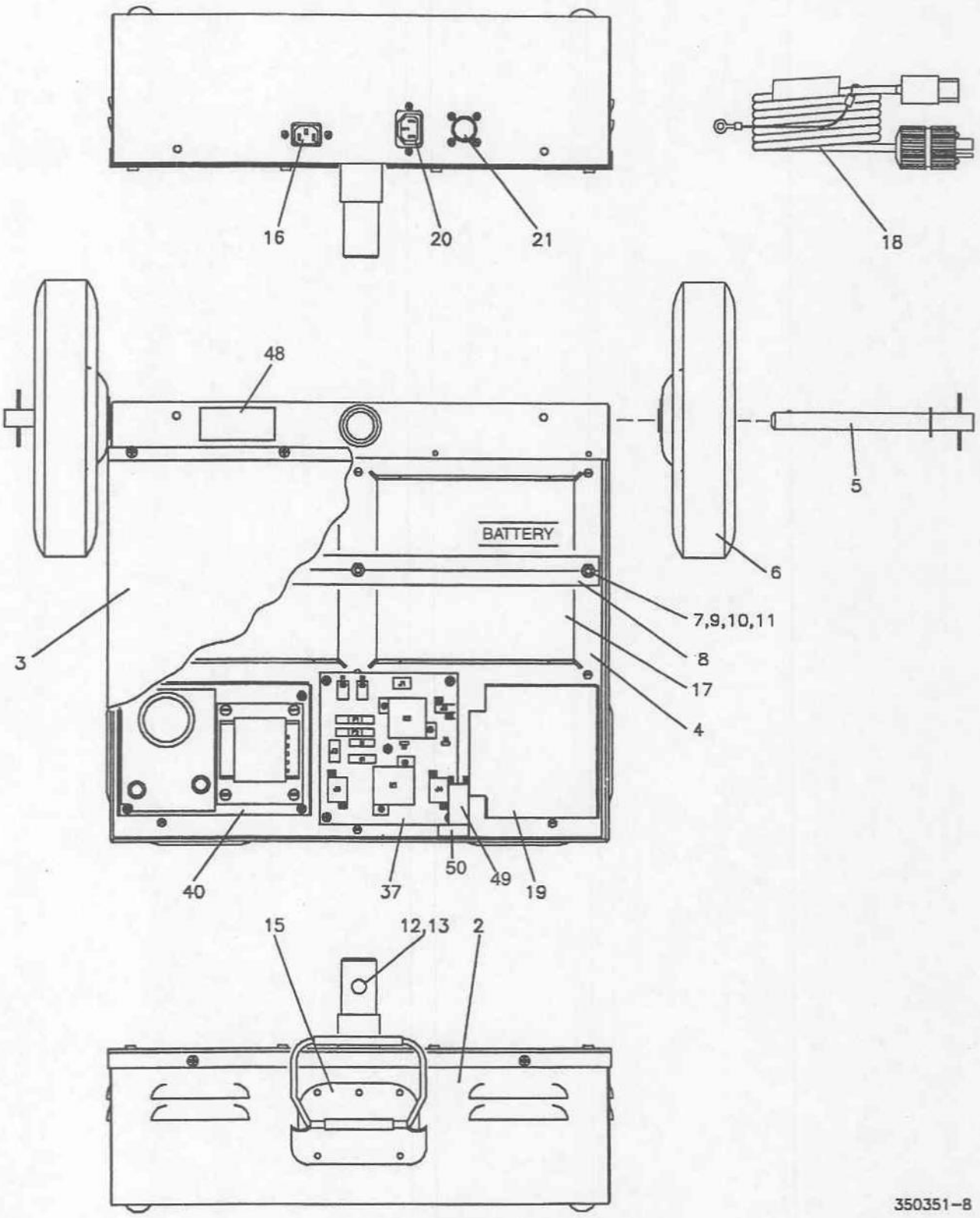


FIGURE 8-6. BASE ASSEMBLY

Base Assembly — Refer to Figure 8-6

ITEM	PART NO.	DESCRIPTION
2	301747	Enclosure, Base
3	301748	Cover, Base Enclosure
4	311052	Plate, Component Mounting
5	311053	Pin, Self-Locking Quick Release
6	311054	Wheel,10 dia Semi-Pneumatic
7	311055	Post, Battery Holddown (1/4-20 x 3-7/8 long)
8	311056	Bracket, Battery Holddown
9	E2177	Washer,1/4 ID x 1/2 OD x 1/16 thick Flat
10	E4671	Washer,1/4 Helical Spring Lock
11	E2239	Nut,1/4-20 Hex
12	311064	Button, Post Release
13	311065	Spring, Post Release Button
15	311074	Handle, Spring-Loaded
16	311075	Receptacle, Power Cord
17	311076	Battery,12V Rechargeable
18	302848	Cord, Base to Outlet, 120 volt
18	302850	Cord, Base to Outlet, 220 volt
19	311077	Power Supply, 24VDC, 2.5A, 60-300W
20	311081	Receptacle, Cord to Lighthead
21	311099	Receptacle, Power Supply
23	E00008	Screw, #4-40 x 1/4 Phillips Pan Head
24	E4932	Screw, #4-40 x 1/4 Phillips Flat Head
27	311086	Cap/Chain, Protective
28	E4941	Screw, #10-32 x 3/8 Phillips Pan Head
29	E7034	Washer, #10 Helical Spring Lock
30	311089	Spacer, 9/64 ID x 1/4 OD x 3/4 long
31	E7093	Screw, #10-32 x 1-1/4 Phillips Pan Head
32	E7041	Washer, #6 Helical Spring Lock
33	E7033	Nut, #10-32 Hex
34	E5010	Screw, #6-32 x1/4 Phillips Pan Head
35	516811	Standoff, #6-32 Internal Thread x 7/16 long
37	514226	Board, Relay PC
38	311092	Harness, Base Assembly
40	311088	Power Supply, 28V, 3 Amp
41	R3500	Gasket, Base Cover (specify length)
42	E6645	Screw, #10-32 x 3/8 Hex Head Ground
43	61419	Washer, #10 Terminal Cup
44	65723	Label, Ground Identification (Protective Earth)
45	—	Decal, Rating
46	16465	Washer,3/16 ID x 3/8 OD x 1/32 thick Flat
47	E7270	Nut,1/4-20 Hex Lock
48	302904	Voltmeter
49	302901	Voltage Sensor
50	302902	8 pin Octal Plug

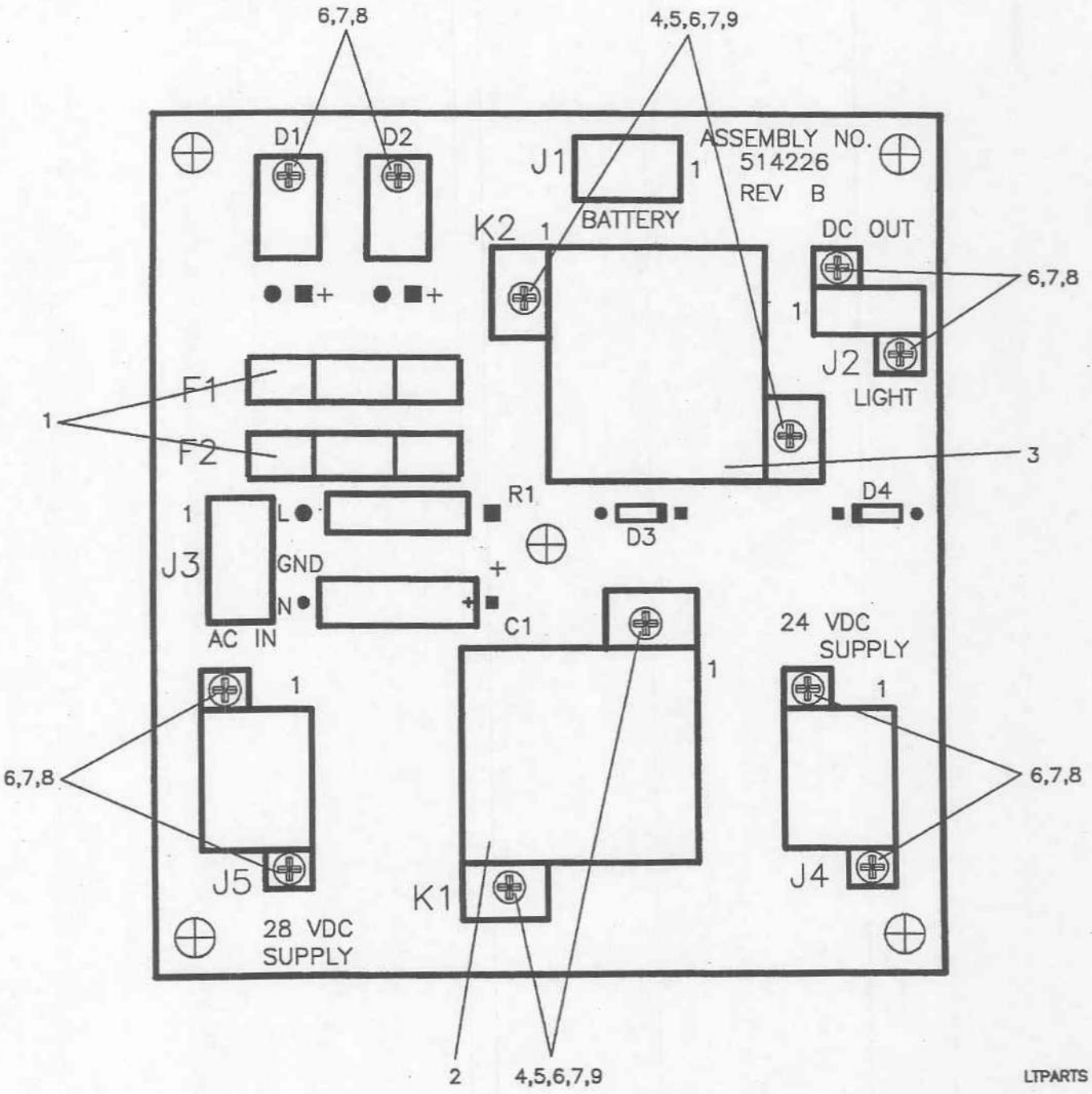


FIGURE 8-7. RELAY PC BOARD

Relay PC Board-Refer to Figure 8-7

ITEM	PART NO.	DESCRIPTION
1	—	Fuse, 2 Amp, 250V Slow-Blow (Bussmann MDA Series)
2	—	Relay, 11 OVDC, 3PDT (Potter & Brumfield KUP-14D15-110)
3	—	Relay, 24VDC, DPDT (Potter & Brumfield KUP-11 D15-24)
4	E0013	Screw, #4-40 x 1/2 Phillips Pan Head
5	E4709	Washer, #4 Flat
6	E2053	Washer, #4 Internal Tooth Lock
7	E7028	Nut, #4-40 Hex
8	—	Screw, #4-40 x 5/32 Phillips Pan Head
9	—	Spring, Holddown (Potter & Brumfield 20C228)
C1		Capacitor, 1 UF, 450V (Sprague TVA-1700)
C2		Diode, 45V,10A (Motorola MBR1045)
D1		Diode, 45V,10A (Motorola MBR-1045)
D3		Diode,1N5002
D4		Diode,1N5002
F1		Clip, Fuse, PC Type (Little Fuse 102-071)
F2		Clip, Fuse, PC Type (Little Fuse 102-071)
J1		Connector, 4-Pin (Molex 09-65-2048)
2		Connector, 3-Pin (Burndy SMS3RE-3TK6)
J3		Connector, 3-Pin (Molex 10-63-1039)
J4		Connector,12-Pin (Burndy SMS12RE-3TK6)
J5		Connector,12-Pin (Burndy SMS12RE-3TK6)
K1		Socket, Relay, 11-Pin (Potter & Brumfield 27E305)
K2		Socket, Relay, 11-Pin (Potter & Brumfield 27E305)

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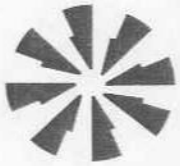

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